UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/884,861	06/19/2001	Alexander Keller	MENT-061	1908

7590 11/25/2005	**EXAMINER**
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40 BROAD STREET	ART UNIT	PAPER NUMBER
BOSTON, MA 02109	2671	

DATE MAILED: 11/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE **3** MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 June 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some * c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____ .

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
     Paper No(s)/Mail Date _____ .

4) ☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____ .

DETAILED ACTION

Drawings

1.   The drawings are objected to under 37 CFR 1.83(a). The drawings must show every

feature of the invention specified in the claims. Therefore, the "a computer graphics method"

must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to

the Office action to avoid abandonment of the application. Any amended replacement drawing

sheet should include all of the figures appearing on the immediate prior version of the sheet,

even if only one figure is being amended. The figure or figure number of an amended drawing

should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure

must be removed from the replacement sheet, and where necessary, the remaining figures must

be renumbered and appropriate changes made to the brief description of the several views of the

drawings for consistency. Additional replacement sheets may be necessary to show the

renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet"

pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will

be notified and informed of any required corrective action in the next Office action. The

objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 101

2.   35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or
> any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and
> requirements of this title.

Claims 17-24 are rejected under 35 U.S.C. 101 because the claimed invention is directed

to non-statutory subject matter. Claims 17-24 recite a computer program product not being

technologically embodied. See MPEP § 2106 with regard to computer programs. To expedite a

complete examination of the instant application, the claims rejected under 35 U.S.C 101 as non-

statutory subject matter are further rejected as set forth below in anticipation of applicant

amending the claims to place them within the four categories of invention.

Claim Rejections - 35 USC § 112

3.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the
> subject matter which the applicant regards as his invention.

4.   Claims 7, 8, 15, 16, 23 and 24 are rejected under 35 U.S.C. 112, second paragraph,

as being indefinite for failing to particularly point out and distinctly claim the subject

matter which applicant regards as the invention.

5.   Claims 7, 15, and 23 use the term "i" in the expression representing the sample points

without any definition. The defective claim can be corrected by incorporating the definition of

the instance number "i" in claim 3, on which the defective claims do not depend.

6.   Claims 8, 16 and 24 are rejected based on their dependence on the defective claim.

Claim Rejections - 35 USC § 102

7.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United
> States before the invention thereof by the applicant for patent, or on an international application by another who
> has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention
> thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999

(AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002

do not apply when the reference is a U.S. patent resulting directly or indirectly from an

international application filed before November 29, 2000. Therefore, the prior art date of the

reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA

35 U.S.C. 102(e)).

8.   Claims 1, 9 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S.

Patent No. 6,028,606 to Kolb et al (herein referred to as "Kolb et al.")

9.   With regard to claim 1, Kolb et al discloses "a computer graphics system (*lines 40-42 of*

column 3: "The camera simulation is implemented in a computer system. A three-dimensional

radiant scene is stored in a memory of the computer system by a standard technique. ") for

generating a pixel value for a pixel in an image, the pixel being representative of a point in a

scene as recorded on an image plane of a simulated camera (*lines 57-63 of column 4: "Further,*

the resulting stored image accurately approximates an image created by a real physical camera

with a specified lens, aperture configuration, shutter setting and film surface. The array of pixels

is often referred to below as the film plane, in keeping with the invention's analogy to a physical

camera system. "; lines 53-56 of column 6: "A thick lens maps each point in object space onto a

single point in image space and all points in the plane of focus map onto the image plane with

uniform magnification. "), the computer graphics system comprising:

    a.   a sample point generator configured to generate a set of sample points

    representing at least one simulated element of the simulated camera (*lines 60-61 of*

    column 3: "An exit pupil is calculated in order to define a region for efficiently sampling

rays. "), the sample points representing elements of a Hammersley sequence (*lines 14-25*

of column 14: "Another sampling technique is to generate quasirandom sample

positions, such as Hammersley points..."); and

b.   a function evaluator configured to generate at least one value representing an

evaluation of said selected function at one of the sample points generated by said sample

point generator, the value generated by the function evaluator corresponding to the pixel

value (*lines 35-41 of column 12: "The value of a pixel 82 is a function of the radiant*

power falling on a hypothetical pixel-sized sensor in the film plane. The radiant power is

given by integrating H(x') over the pixel area 82. In light of equation (04) this is

equivalent to an integration over a four-dimensional domain of pixel area and exit pupil

area. This is estimated by sampling radiance over this domain. ").

10.   Claim 9 is with the rationale of claim 1. Claim 9 recites limitations that are similar in

scope to those of claim 1, but as a method, which is taught by Kolb el al in lines 27-28 of column

3: "The present invention is a method for modeling a physical camera in a computer graphics

systems."

11.   Claim 17 is with the rationale of claim 1. Claim 17 recites limitations that are similar in

scope to those of claim 1, but as a computer program product, which is taught by Kolb el al

(*lines 40-42 of column 3: "The camera simulation is implemented in a computer system. A three-*

dimensional radiant scene is stored in a memory of the computer system by a standard

technique. ") One of ordinary skill in the art would recognize that a method implemented in a

computer system that is stored in the computer system's memory is a computer program product.

Claim Rejections - 35 USC § 103

12.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

13.   The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1.   Determining the scope and contents of the prior art.
2.   Ascertaining the differences between the prior art and the claims at issue.
3.   Resolving the level of ordinary skill in the pertinent art.
4.   Considering objective evidence present in the application indicating obviousness
      or nonobviousness.

14.   Claims 2, 4, 6, 10, 12, 18, 20 and 22 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Kolb et al in view of Applicant's admitted prior art: Andrew Keller,

"Instant Radiosity," August 3, 1997, Computer Graphics Proceedings, SIGGRAPH 97, p.

49-56 (herein referred to as "Keller et al.")

15.   With regard to claims 2, 10, and 18, Kolb et al discloses the limitations of parent claim 1,

but does not show a jittered sample point positions on a subpixel grid. Keller et al teaches

"generating sample position points x, representing jittered sample point positions on a subpixel

grid for at least one pixel on the image plane" (*2nd paragraph of section 4.1: "Applied to pixel*

supersampling for antialiasing as in [HA90], the two dimensional jittered Hammersley sequence

exposes an even faster convergence than standard variance reduced sampling."; Figure 5 shows

a grid). One of ordinary skill in the art would recognize that a "pixel super sampling" is a term

for generating a plurality of sample points for one pixel.

16.   Kolb et al and Keller are analogous art because they are from the same field of endeavor:

image rendering. At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to use jittered Hammersley sample points as taught by Keller as the sampling

strategy as part of the camera simulation system, computer graphics method and computer

program product disclosed by Kolb et al. The motivation for doing so would have been to

achieve the faster convergence than the Hammersley sample points as shown by Keller in Figure

6, which compares the convergence of Hammersley sample points and the jittered Hammersley

sample points. Therefore, it would have been obvious to combine Keller with Kolb et al to obtain

the invention specified in claim 2, 10 and 18.

17.   Claims 4, 12 and 20 are met by the combination of Kolb et al and Keller, wherein Kolb et

al discloses "the simulated camera is to be provided with a shutter (*lines 57-60 of column 4:*

"Further, the resulting stored image accurately approximates an image created by a real

physical camera with a specified lens, aperture configuration, shutter setting and film surface."),

and the sample point generators configured to generate, for at least one sample point position on

a subpixel for at least one pixel on the image plane (*lines 43-45 of column 12: "Sampling*

consists of first choosing (102) a point x' in the pixel area and then choosing (104) a point x" in

the exit pupil."), sample time points $t_{i,j}$ representing "j" points in time during a time interval t_0 to

t_0+T (*lines 3-5 of column 13: "Finally (122), the delta-exposure value $\Delta H(x",x')$ of the sample is*

computed $\Delta H(x",x')=T\ W\ L(x",x')$, where T is the exposure time.") during which the shutter is to

be open for use by the function evaluator in evaluating the selected function (*lines 44-46 of*

column 10: "The exposure H(x') is the integral of the irradiance on the point x' in the film plane

over the time that the shutter is open. ").

18.   Claims 6 and 22 are met by the combination of Kolb et al and Keller, wherein Kolb

discloses "the simulated camera is to be provided with a lens *(lines 48-50 of column 3: "The*

geometric relationships between the lens system, object, and image surface are modeled by

precise placement and movement of lens elements. "), and the sample point generator is

configured to generate, for at least one sample point position *(lines 43-45 of column 12)* and at

least one sample time point *(lines 3-5 of column 13),* sample lens position points $y_{i,j,k}$

representing "k" points on the lens for use by the function evaluator in evaluation the selected

function" *(lines 8-10 of column 10: "If each group of lens elements does not sufficiently exhibit*

ideal image formation, then the exit pupil is defined to be the surface 34(m) of the rear-most

lens-element.": lines 38-41 of column 12: "In light of equation (04) this is equivalent to an

integration over a four-dimensional domain of pixel area and exit pupil area. This is estimated

by sampling radiance over this domain. ").

Allowable Subject Matter

19.   Claims 3, 5, 11, 13 and 14 are objected to as being dependent upon a rejected base claim,

but would be allowable if rewritten in independent form including all of the limitations of the

base claim and any intervening claims.

20.   Claims 7, 8, 15 and 16 would be allowable if rewritten to overcome the rejection(s) under

35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations

of the base claim and any intervening claims.

21.   The following is are the statements of reasons for the indication of allowable subject

matter: With regard to claims 3 and 11, Keller et al shows jittering the sampling positions

according to the Hamersley sequence, but does not provide the expressions for the sample

position points recited in claims 3 and 11. Furthermore, the expression recited in claims 3 and 11

would not have been obvious in view of the prior art: Robert L. Cook, "Stochastic sampling in

computer graphics," January 1986, ACM Transactions on Graphics (TOG), Volume 5, Issue 1, p.

51-72 (herein referred to as "Cook et al.") Cook et al teaches an expression for jittered samples

in Figure 11c, but does not teach instance numbers defined according the expressions recited in

claim 3. At the time of the invention, it would not have been obvious to obtain the recited

expressions.

22.   With regard to claims 5 and 13, Kolb et al discloses sampling time points as shown in the

rejection of claims 4 and 12, but does not disclose the expression in claims 5 and 13. At the time

of the invention, it would not have been obvious to define the sample time points as such.

20.   With regard to claims 7 and 15, Kolb et al discloses sampling the lens points as shown in

the rejection of claims 4 and 12, but does not disclose the expression in claims 7 and 15. At the

time of the invention, it would not have been obvious to define the sample lens points as such.

Conclusion

23.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. Tien-Tsin Wong, Wai-Shing Luk, Pheng-Ann Heng, "Sampling with Hammersley

and Halton Points", 1997, Journal of Graphics Tools, Vol. 2, No. 2, pp. 9-24 teaches using

Hammersley points in a ray tracing application. U.S. Patent No. 6,529,193 to Herken et al

discloses a system that generates pixel values using the Halton sequence.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The

examiner can normally be reached on Monday through Friday 8:30 am -5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JMR

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER